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Atmospheric Measurement Techniques Discussions

Interactive comment on "MISR calibration issues in high-contrast scenes, and empirical corrections" *by* J. A. Limbacher and R. A. Kahn

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Paper summary ———— This paper notes that there is a bias of 0.01 in Aerosol Optical Depth (AOD) over dark ocean, between MISR aerosol products and AERONET. This is found to be the case where AOD < 0.10 . The authors have studied a specific scene type, where a well-defined bright area is adjacent to a dark-water target. For this they have quantified the amount of "ghosting" from the bright area into the dark area. An empirical correction algorithm is then developed, used to correct for three hypothesized stray-light mechanisms. Once the correction is applied and the MISR data processed using their research algorithm, the AOD bias is reduced to 0.003.

In their development, the authors have made the following adjustments to the MISR

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radiances, before processing the data in their research algorithm (RA): 1) converted radiances to in-band reflectances 2) included a 1.06 gain adjustment in the An-Red band, and a gain 1.05 adjustment in the An-NIR band. 3) added a correction for a primary ghost image 4) added a correction for a secondary ghost image 5) added a correction for spatial smearing (point-spread-function effect)

Questions to the authors ———————— 1) The gain adjustments to the red and NIR bands are not corroborated by the validation done in Bruegge et al. (2014). Since the primary focus of this paper is the ghosting correction, how significant is the band-relative corrections? What reduction in AOD bias is found, if only the ghosting correction is applied?

2) Considering the MISR aerosol product already meets the required ± 0.05 uncertainty in AOD, what are the science drivers for improving the residual bias of 0.01?

3) The MISR instrument makes use of four different camera designs, suggesting that the "one size fits all" set of parameters is not desirable. Coefficients computed for the nadir-camera are likely not applicable to the off-nadir cameras. Although the lens designs have some characteristics in common, the lens spacings and prescriptions are different. What future work will you pursue? For example, will you examine the off-nadir camera imagery for ghosts and investigate the impact of applying the nadir camera corrections to the images to ensure that artifacts are not introduced?

4) A previous publication, Bruegge et. al (2004) has quantified the MISR ghosting problem for the Bf camera to be on the order of 0.3%, that is, the magnitude of a structured ghost of iceberg in a dark ocean was found to be 0.3% of the brightness of the actual iceberg. How do the magnitudes of structured ghosts in your study compare to this value?

5) The secondary mirroring about points one-quarter and three-quarters across the field of view is not consistent with physical optics behavior. The term has a very large blur diameter and lower gain coefficient, giving it less of a structured character and

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smaller magnitude than the primary mirroring term. What is the magnitude of AOD improvement if this term is not included? (see suggestion 3 below)

Editorial suggestions ———————— 1) Clarify Figure 6; label (or at least define) the axes. The text is difficult to follow.

2) With respect to the 4 bullets on page 2537: * the first might be called "stray-light" – then you could elaborate that these inlude ghosting, due to camera internal reflections, and veiling light, due to scattering within the camera. * "3D effects" – this is not a camera stray-light phenomena and should not be in a list of MISR camera artifacts. If there were a 3D effect, this would be due scattering within the vertical structure of the atmosphere, and would have to be accounted for in the Level 2 (aerosol retrieval) algorithm. * I would add PSF effects, since you include such a term in your correction equation. * rank the effects having the most significant effect on AOD (as opposed to cost function), vs those with no effect. (i.e. move latency last), or maybe in the order you later apply a correction. These suggestions might strengthen the connection between this list, and what data manipulations are done later in the paper; that is, will make the paper flow better.

4) I agree with Reviewer #1, that "calibration" may not be the best descriptor for the title. Perhaps a better title would be: "The impact of stray-light in high-contrast scenes on MISR aerosol retrievals over dark water"

Summary ——- This paper has shown that stray light in the MISR cameras can affect the retrieval of AOD. An empirical algorithm is developed that has reduced the bias between AOD derived from their Research Algorithm and AERONET. It demonstrates that improvements in the derived products that can be made, if a stray-light correction algorithm were to be implemented.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 2521, 2015.